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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/636,168	08/07/2003	Dong Joon Kim	29936/39478	2102

4743 7590 04/29/2004

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EXAMINER	
NHU, DAVID	

ART UNIT	PAPER NUMBER
2818	

DATE MAILED: 04/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/636,168	KIM, DONG JOON	
	Examiner	Art Unit	
	David Nhu	2818	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 August 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *01*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAIL ACTIONS

Claim Objection

*1. Claim 1, line 12, "**the** sidewall" lacks a clear antecedent basis. Claim 5 is also. Claim 8, "the cooling process is slowly implemented 10-50 °C/min" should be –the cooling process is slowly implemented at a rate of 10-50 °C/min-- See page 7, line 16.*

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claim 1-11 are rejected under U.S.C 103(a) as being unpatentable Hung et al (6,380,096 B2) in view of Huang et al (6,355,571 B1).

Regarding claim 1, Hung, figures 1-12, and related text on col. 1-16, (figures 2, 5-10), disclose a method of forming a metal line in a semiconductor device, comprising the steps of: forming an interlayer insulating film 12, 14, 16, 20 on a semiconductor substrate 10 in which a lower line 11 is formed; patterning the interlayer insulating film to form an aperture unit 100, 104 for forming an upper line 134 connected to the lower line 11; cooling the semiconductor substrate in which the aperture unit is formed at a given temperature; implementing an annealing/heating process in-situ within a chamber in which the cleaning process is implemented; burying the aperture unit with a conductive material 132 to form an upper line 134.

It is noted that Hung fails to teach the step of implementing a cleaning process using a hydrogen reduction reaction in order to remove polymer formed on a sidewall of the aperture unit and a metal oxide film formed on the lower line.

However, Huang, figures 1-3, and related text on col. 1-8, (figures 1, 2), teach the step of implementing a cleaning process using a hydrogen reduction reaction in order to remove polymer formed on a sidewall of the aperture unit and a metal oxide film formed on the lower line.

Regarding claims 2-11, Hung, col. 1-16, and Huang, col. 1-8, also teach the aperture unit is a contact hole/plug, a trench, a dual damascene pattern consisting of a via hole and a trench; the cleaning process is implemented using hydrogen, nitrogen, argon gas of sccm, a power source, a pressure, and a temperature; the interlayer insulating film having a low dielectric constant; the lower line is copper; forming the aperture unit comprises: etching the interlay insulating film to form a via hole; burying the via hole with an ARC film; and etching a part of the interlay insulating film to form a trench having an aperture unit wider than the via hole and exposing the lower line through the via hole; depositing a metal seed layer on a barrier film; forming a metal film on the metal seed layer using an electroplating method, thus burying the aperture unit; polishing (CMP) the metal film to form an upper line.

It would have been obvious to one having ordinary skill in the art at the time of the present invention to apply the teachings of Huang into Hung as they are related to the same subject matter of forming a metal conductive line in a substrate by a cleaning process using a hydrogen reductive reaction and an heating process in-situ in a chamber.

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Dai'762, Nagayama'757, Kotecha'820, Imai'247 are cited as of interest.

5. A shortened statutory period for response to this action is set to expired 3 (three) months from the date of this letter. Failure to respond within the period for response will cause the application to become abandoned (see 710.02 (b)).

6. Any inquiry concerning this communication on earlier communications from the examiner should be directed to David Nhu, (571)272-1792. The examiner can normally be reached on Monday-Friday from 7:30 AM to 5:00 PM. The examiner's supervisor, David Nelms can be reached on (571)272-1787.

The fax phone number for the organization where this application or proceeding is assigned is (703)872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956

David Nhu

April 14, 2004